

PROPLEURAL TRANSFORMATIONS WITH RESPECT TO  
THE DISPOSITION OF PROPLEURAL SUTURE  
IN ORDER HYMENOPTERA

MALKIAT S. SAINI

Department of Zoology, Punjabi University, Patiala-147002, India

*Abstract.*—A distinct propleural suture, well developed proepisternum and considerably reduced proepimeron are clearly represented in Pamphiliidae, Xyelidae, Argidae, Tenthredinidae, Diprionidae and Cimbicidae. In Cephidae, this suture has shifted slightly backward, thus, further reducing the area of proepimeron. In Xiphydriidae, the backward shift is more pronounced and the posterior half of this suture has become marginal. In Siricidae, the entire propleural suture has become almost marginal and the epimeral area if any is in the form of a thickened posterior margin of propleural plate. In most of the apocritan families the same state is maintained. In Formicidae even the thickened posterior margin of propleuron is absent. These observations collectively help to establish a systematically changing pattern to which can be attached some evolutionary significance within the order Hymenoptera.

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The work that follows specifically deals with the positional variations and gradual backward shifting of the propleural suture within the order Hymenoptera. The extent and magnitude of the changes pertaining to the course of this suture as well as the size of the epimeron are evolutionarily significant and bring to light some phylogenetic relationships among different families of this insect order. The available literature is completely devoid of such comprehensive studies excepting those of Snodgrass (1910) and Matsuda (1970) which cover too limited a number of hymenopteran families.

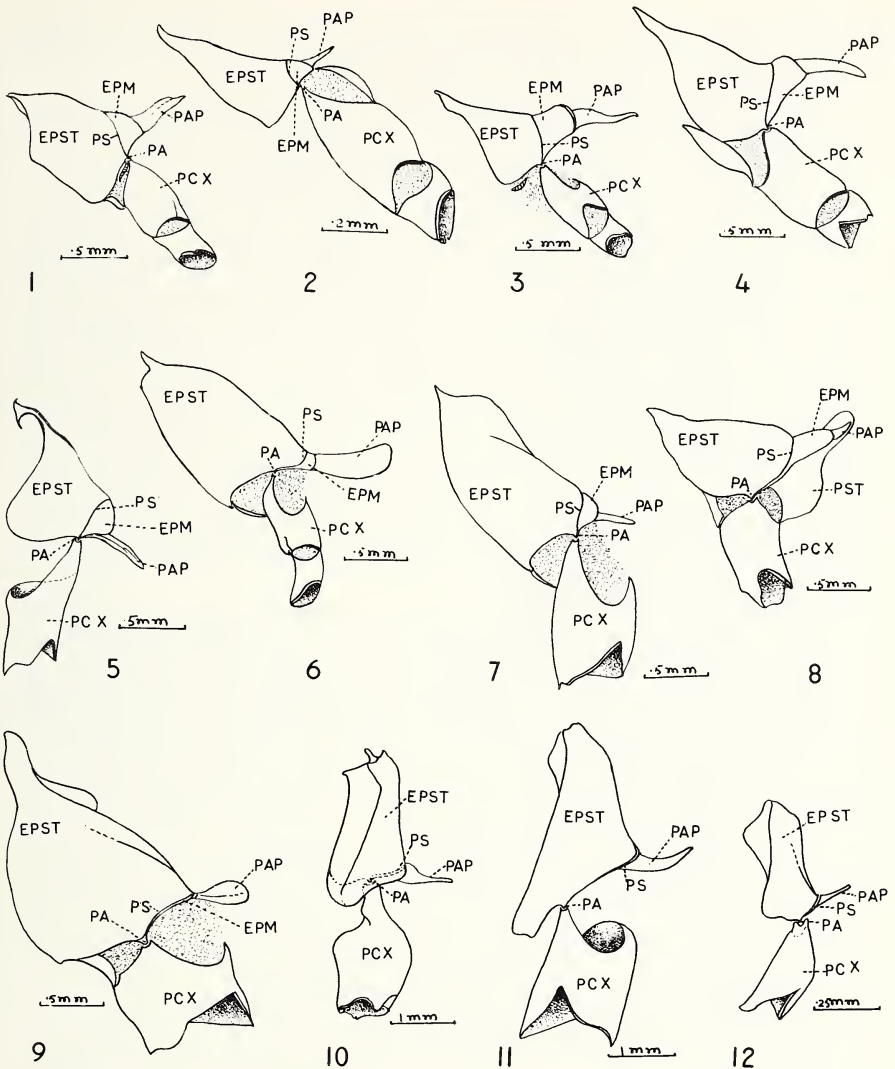
However, a good deal of literature is available concerning the hymenopteran morphology. Some important works include Crampton (1909, 1926), Snodgrass (1942), Martin (1916), Weber (1927), Duncan (1939), Alam (1951), Arora (1953), Wong (1963) and Dhillon (1966). These authors mainly worked on an ontological basis rather than on the comparative basis, which is the main objective of the present work. This work is based on the study of 22 different hymenopteran families.

MATERIALS AND METHODS

Most specimens of Apocrita were collected from the Punjab and Himachal Pradesh during September and October 1975 and preserved in 80 percent alcohol. Except for Megalodontidae, Orussidae and Pergidae, Symphyta were supplied by the Biosystematic Research Institute, Canada, and the Zoological Survey of India. Since these specimens were dry, they were softened in 2 percent KOH for 6 days. Drawings were made with the help of a binocular microscope fitted with an ocular grid.

OBSERVATIONS AND DISCUSSION

The presence of a distinct propleural suture in some lower symphytans with its gradual backward displacement among the higher symphytans till it takes up a mar-

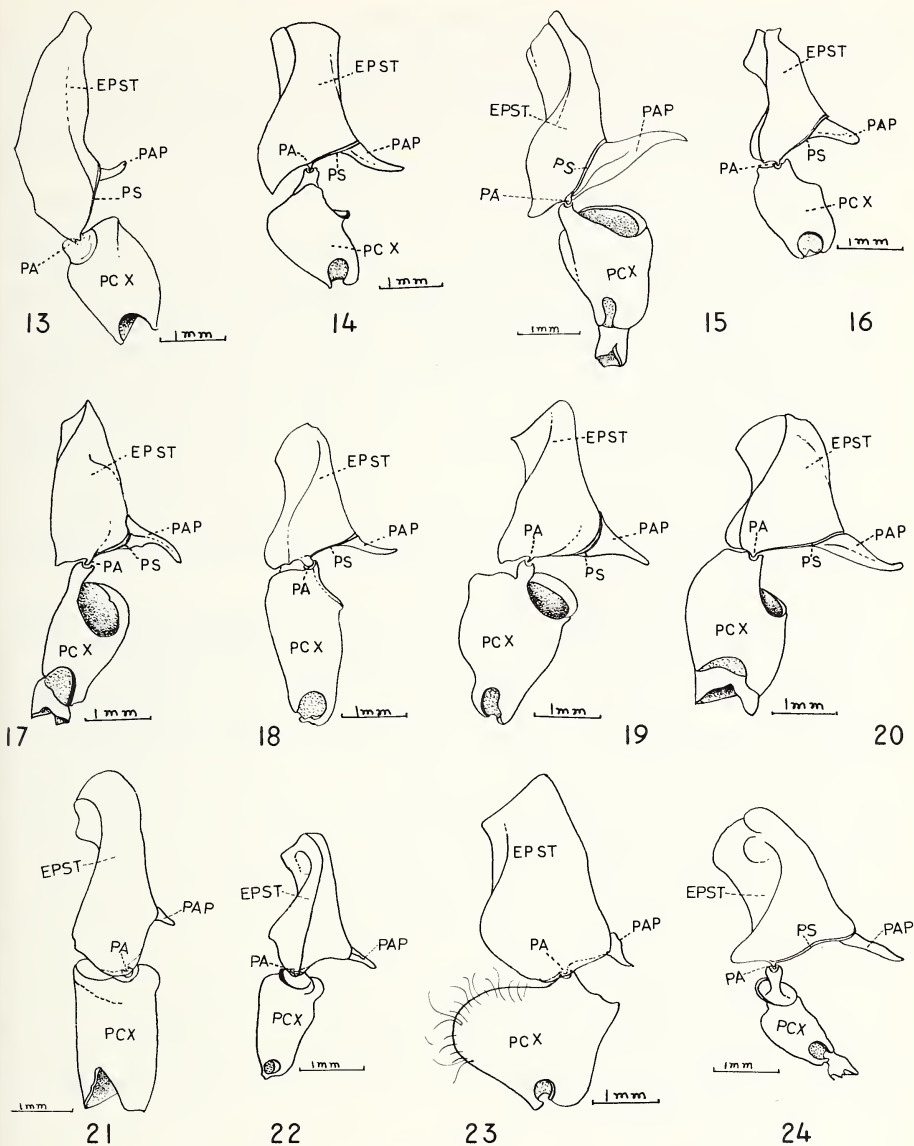


Figs. 1-12. Side view of the propleural plate of: 1. *Acantholyda maculiventris* (Pamphiliidae). 2. *Xyela bakeri* (Xyelidae). 3. *Arge clavicornis* (Argidae). 4. *Neodiprion abietis* (Diprionidae). 5. *Tenthredo verticalis* (Tenthredinidae). 6. *Xiphydria mellipes* (Xiphydriidae). 7. *Cephus cinctus* (Cepidae). 8. *Cimbex americana americana* (Cimbricidae). 9. *Sirex cyaneus* (Siricidae). 10. *Netelia kashmirensis* (Ichneumonidae). 11. *Trachysphyrus* sp. (Ichneumonidae). 12. *Sycoscapter stabilis* (Torymidae). Abbreviations (used also in Figs. 13-24): EPM—epimeron; EPST—episternum; PA—pleural articulation; PAP—pleural apophysis; PCX—procoxa; PS—pleural suture; PST—prosternum.

ginal course in the members of family Siricidae and all of the Apocrita, indicates a trend which may have some evolutionary and phylogenetic significance. A coherent account of all these modifications is as follows.

In *Acantholyda maculiventris* (Norton) (Fig. 1) (Pamphiliidae), *Xyela bakeri* Konow (Fig. 2) (Xyelidae), *Arge clavicornis* (F.) (Fig. 3) (Argidae) *Tenthredo verticalis* Say (Fig. 5) (Tenthredinidae), *Cimbex americana americana* Leach (Fig. 8) (Cimbicidae) and *Neodiprion abietis* (Harris) (Fig. 4) (Diprionidae) the propleural suture is well represented. In all these cases this suture takes up a course which starts from the pleural articulation of the first coxa, curves around the posterodorsal angle of the propleural plate and ends up at the base of the concavity which receives the lateral tip of the furcal arm of the prosternum. Internally, this suture is represented by a distinct pleural ridge. The small area lying posterior to this suture is the proepimeron, the large dominating area anterior to this suture being the proepisternum. Similar conditions have also been observed in *Onycholyda luteicornis* (Norton) and *Cephalcia provancheri* (Huard) (Pamphiliidae), *Zarae inflata* Norton (Cimbicidae), *Pristiphora cincta* Newman, *Pachyprotasis versicolor* Cameron, *Pachyprotasis brunetti* Rohw. and *Eutomostethus assamensis* (Rohw.) (Tenthredinidae). Such a condition has also been described and similarly labelled by Snodgrass (1910), Wong (1963) and Dhillon (1966) and under the name of cervicopleuron by Crampton (1909, 1926), Martin (1916), Weber (1927) and Arora (1953).

Matsuda (1970) in *Arge* sp. took the generalized propleural suture as the anapleural suture and thus labelled the area anterior to it as the combination of pre-episternum and the kate-episternum while the small area lying posterior to this suture as the anepisternum. According to him the actual propleural suture has become marginal and consequently the area of proepimeron has been obliterated. In addition to the anapleural suture, Matsuda showed the presence of a separate submarginal propleural suture in *Schizocerus* sp. and *Dolerus* sp.—on which Weber (1927) and Crampton (1926) worked, respectively—but did not label any separate submarginal suture. However, on the basis of comparative study the present author is of the view that there exists no anapleural suture in the propleuron of Symphyta. As the anapleural suture of Matsuda (1970) bears some of the identification marks of the pleural suture, i.e., its ventral end forms the pleural articular condyl which provides the pleural articulation to the procoxa (a condition very much similar to meso- and metapleuron and its dorsal end forms an articular facet which receives the lateral tip of the furcal arm of the prosternum, a condition again similar to that usually met with meso- and metafurcasternal arms which are generally associated with the pleural suture, particularly in Symphyta), so it is proposed to take this suture as the propleural suture. To substantiate the above view it is further added that anapleural suture is not a constant feature of all the symphytans (Saini and Dhillon, 1980), whereas, the pleural suture is a constant feature within the entire range of Symphyta. Moreover, when present, the anapleural suture takes up altogether a different and variable course than that of the pleural suture (Matsuda, 1970; Saini and Dhillon, 1980). To confirm the validity of Matsuda's (1970) anapleural suture and a marginal pleural suture in *Arge* sp. the present author studied some more species of *Arge*, viz. *Arge simlaensis*, *A. fumipennis*, *A. bipunctata*, and *A. xanthogastra*, but failed to recognise any marginal suture. However, if in the insect studied by Matsuda (1970) any marginal suture is



Figs. 13–24. 13. *Chrysis indogotea* (Chrysididae). 14. *Scolia quadripustulata* (Scoliidae). 15. *Scelephron intrudens* (Sphecidae). 16. *Stizus vespiformis* (Sphecidae). 17. *Eumenes dimidiatipennis* (Eumenidae). 18. *Calicurgus* sp. (Pompilidae). 19. *Vespa orientalis* (Vespidae). 20. *Xylocopa lemuisca* (Xylocopidae). 21. *Camponotus camelinus* (Formicidae). 22. *Tetraponera rufonigra* (Formicidae). 23. *Dorylus labiatus* (Formicidae). 24. *Mutilla* sp. (Mutillidae).



present, that can be safely taken as the transepimeral suture as is the case in mesoepimeron of *Arge clavicornis* (Saini and Dhillon, 1980).

The next stage in the evolutionary series can be observed in the members of family Cephidae. In *Cephus cinctus* Norton (Fig. 7) due to the backward shifting of the propleural suture the area of the epimeron is further narrowed. However, the identification marks of the suture are quite prominent and distinct.

In *Xiphydria mellipes* Harris (Fig. 6) (Xiphydridae) the backward shifting of this suture is more pronounced and consequently the area of epimeron has been further reduced. At this stage the basal half of this suture has become already submarginal. This shows an inclination of this suture for becoming submarginal, a fact which is evident in siricids. The identifying features of the pleural suture are quite clear.

In *Sirex cyaneus* F. (Fig. 9) (Siricidae) the propleural suture has become submarginal and consequently the area of proepimeron has been almost obliterated. Submarginal nature of the suture can be confirmed by the presence of a distinct submarginal ridge, which on its ventral end gives rise to the pleural articular condyle, that provides pleural articulation to the procoxa. However, the dorsal half of the pleural ridge leading to the concavity which receives the furcal arm of the furcasterium has become almost inconspicuous. So, on the whole the propleural plate is entirely represented by proepisternum alone. Similar conditions have also been described by Snodgrass (1910) in *Tremex columba* (Siricidae).

In Hymenoptera Apocrita, the propleural suture has become completely marginal, thus, losing its independent identity. Its ancestral presence is indicated only by the thickened posterior margin of the propleuron. This thick margin is thought to contain the remnants of the pleural ridge. The other remnants of the disappeared pleural suture are the presence of pleural articular condyle and an association of the furcal arm of the prosternum with this thickened posterodorsal margin. The above observations have been made on different apocritans which include *Sycosapter stabilis* (Walker) (Fig. 12) (Torymidae, Chalcidoidea), *Netelia kashmirensis* Cameron (Fig. 10) and *Trachysphyrus* sp. (Fig. 11) (Ichneumonidae), *Chrysis indogotea* Duf. et Pesr. (Fig. 13) (Chrysididae), *Mutilla* sp. (Fig. 24) (Mutillidae), *Scolia quadripustulata* F. (Fig. 14) (Scoliidae), *Scelephron intrudens* Smith (Fig. 15) *Stizus vespiformis* F. (Fig. 16) (Sphecidae), *Vespa orientalis* L. (Fig. 19) (Vespidae), *Eumenes dimidiatepennis* Sauss (Fig. 17) (Eumenidae), *Calicurgus* sp. (Fig. 18) (Pompilidae) and *Xylocopa lemuisca* Westwood (Fig. 20) (Xylocopidae). Similar conditions have been described by Duncan (1939), Snodgrass (1942) and Alam (1951). However, in Formicidae as seen in *Dorylus labiatus* Shuckard (Fig. 23), *Camponotus camelinus* Smith (Fig. 21) and *Tetraponera rufonigra* (Jerdon) (Fig. 22) even the thickened posterior margin of the propleuron is absent.

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